Aqua

Monitoring the Earth's Water Cycle and Associated Variables from the Vantage of Space

Photos of the Aqua spacecraft at TRW in Redondo Beach, California, with all instruments on board. After launch, the solar array will be unfurled, instrument doors will be opened, and antennas will be deployed, with the resulting configuration indicated in the line drawing on p. 2. (Photos courtesy of TRW.)

Aqua Overview

Issues of climate and climate change have considerable relevance to all species of life on Earth. Furthermore, they have received much publicity over the past many years, particularly because of the realization that humans could be having unintended and perhaps detrimental impacts. Nonetheless, the understanding of the Earth/atmosphere system remains inadequate to sort out with certainty human from non-human impacts on long-term climate or to predict with high confidence the likely course of climate changes over the next several decades.

Aqua is a satellite mission aimed at improving our understanding of the Earth/atmosphere system, along with changes occurring within it, through the monitoring and analysis of dozens of Earth variables from a space-based platform orbiting the Earth. Aqua is part of the Earth Observing System (EOS), an international Earth-focused satellite program centered at the United States (U.S.) National Aeronautics and Space Administration (NASA).

"Aqua" being Latin for "water", the Aqua mission is named for the large amount of information it will collect about the Earth's water cycle, including ocean surface water, evaporation from the oceans, water vapor in the atmosphere, clouds, precipitation, soil moisture, sea ice, land ice, and snow cover on the land and ice. Additional variables also being measured by Aqua include radiative energy fluxes, atmospheric aerosols, vegetation cover on the land, phytoplankton and dissolved organic matter in the oceans, and air, land, and water temperatures. One particularly exciting benefit anticipated from Aqua is an improvement in weather forecasting resulting from the Aqua atmospheric temperature and water vapor profiles.

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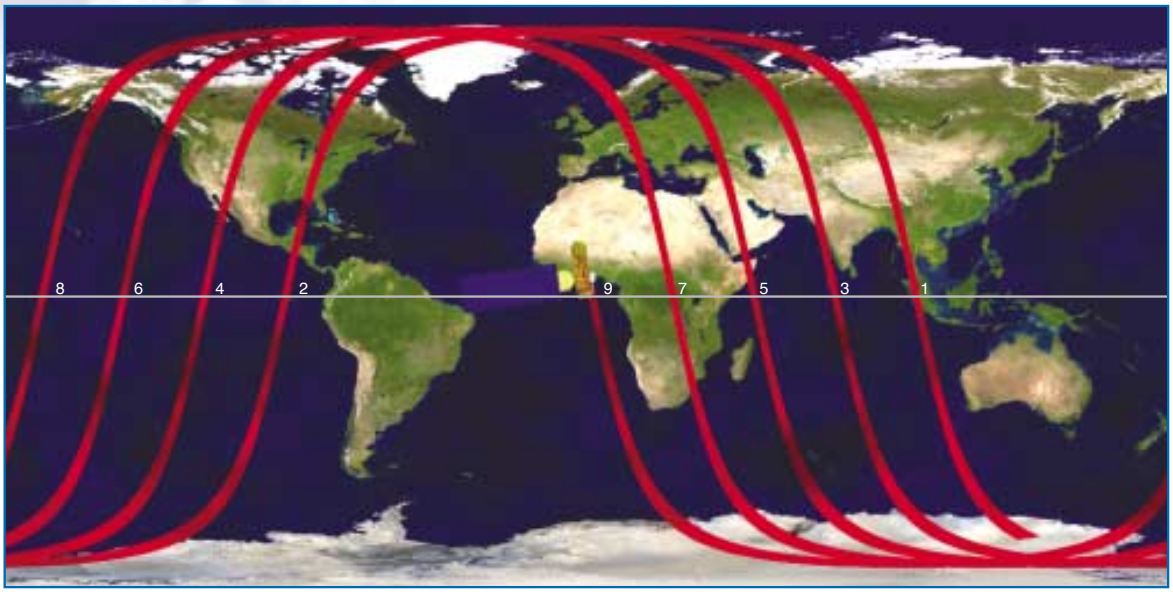

Schematic of the Aqua orbit, with nine consecutive passes over the equator labeled sequentially. Aqua will orbit the Earth at an altitude of 705 km and will approach but not pass directly over the North and South Poles. As the satellite passes northward across the equator, it will do so at 1:30 p.m. local time, then, 49.4 minutes later, as it passes southward across the equator on the opposite side of the Earth, it will do so at 1:30 a.m. local time. (Schematic by Jesse Allen.)

The Aqua spacecraft will carry six major Earth-observing instruments and will be launched from Vandenberg Air Force Base in California, on board a Delta II 7920 - 10L launch vehicle. The launch is scheduled for no earlier than April 18, 2002. Once the spacecraft is launched, it will be maneuvered into a near-polar orbit at an altitude of 705 kilometers, with the satellite orbiting the Earth every 98.8 minutes and crossing the equator on its northward journey at 1:30 p.m. local time and on its southward journey at 1:30 a.m. local time. This will allow collection of afternoon data (as well as 1:30 a.m. data), complementary to the collection of morning data (about 10:30 a.m.) by the EOS Terra satellite launched in December 1999. In order to emphasize the afternoon/morning contrast, the Aqua and Terra missions were originally named EOS-PM and EOS-AM, respectively.

The six Earth-observing instruments on Aqua are:

- Atmospheric Infrared Sounder (AIRS)
- Advanced Microwave Scanning Radiometer for EOS (AMSR-E)
- Advanced Microwave Sounding Unit (AMSU)
- Clouds and the Earth's Radiant Energy System (CERES)
- Humidity Sounder for Brazil (HSB)
- Moderate Resolution Imaging Spectroradiometer (MODIS)

Technically, the spacecraft will be carrying eight Earth-observing instruments, as it has two identical copies of the CERES and the AMSU consists of two physically separate units, the AMSU-A1 and AMSU-A2. Also, Aqua carries several additional instruments, to run the spacecraft, format and store the data, and send the data to the ground. Using standard satellite terminology, however, the Aqua spacecraft is generally said to have six instruments, as listed above. Of these, the AMSR-E is provided by Japan, the HSB is provided by Brazil, and the other four instruments plus the spacecraft, the launch vehicle, and the launch are provided by the United States.